

# LCT-14

## INSTRUCTION MANUAL



### NOTICE

The functionality of the instrument may be impaired if the system is used in a manner not specified in this manual.

### NOTICE

The present manual is an accessory part of the LCT-14. Please retain these instructions for future reference.

#### **QBIT Srl**

via La Farina 47  
50132 Firenze - ITALIA  
Tel: +39.0573.72660  
Fax: +39.0573.72660  
[sales@qbit-optronics.com](mailto:sales@qbit-optronics.com)

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## **GENERAL NOTICES**

QBIT s.r.l. is responsible of safety, reliability and performance only if:

- . the system is used according to the instructions reported in this manual – regarding both safety precautions and use;
- . any change, adjustment and maintenance operation is performed by qualified personnel duly authorized by QBIT s.r.l. ;
- . the instrument is connected to an electrical system which is consistent with both IEC and local directions;

**The system LCT-14 is a portable Particulate Matter (PM) detector. The field of use is air quality monitoring, in industrial plants, working stations or residence buildings.**

**It may be used both in “indoor” and “outdoor” applications. In the latter case, it must be placed in protected areas, in order to prevent exposure to strong rainfall, snow or hail.**

## **FOREWARD**

The following instructions must be carefully read and observed in order to properly install the system and avoid any damage risk.

### **1. UNPACKING AND INITIAL CHECKS**

When you receive the instrument, please unpack it promptly and make a visual inspection to make sure that no damage has occurred during shipment and that all the ordered items have been received. If damage was found, immediately file a claim with the carrier.

N.B.: by law, any good is shipped at buyer's risk and, if not clearly stated, without insurance.

QBIT is not responsible of any damage following dispatch, freight, unloading and unpacking.

### **2. OPERATION ENVIRONMENT**

The operation environment must be consistent with local directives regarding the electrical system and human working area.

### **3. LIABILITY**

QBIT warrants, as final seller, that the system is consistent with CE Council Directives N° **2014/53/EU** (Electromagnetic Compatibility) and **2014/35/EU** (Electrical safety of low voltage equipment).

The responsibility of use, safety in the working area and any other action rests entirely with the employer, following local laws and European Directive N° 89/391/CEE.

The only manufacturer responsibility is that stated by local laws and European Directives.

The manufacturer is not responsible for any impairment due to installation, use and maintenance not consistent with the instructions reported in the present manual.

The manufacturer is not responsible for the lack of any care and safety precaution necessary to avoid every damage or prejudice.

#### **4. WARRANTY**

QBIT s.r.l. warrants that, at the time of delivery, this product is free from defects or malfunctions, and it conforms substantially to the specifications reported in the present manual. QBIT's liability is limited to the repair or replacement, at QBIT's option, of this product or parts thereof returned to seller and shown to QBIT's reasonable satisfaction to have been defective; provided that written notice of the defect shall have been given by Buyer to QBIT within one (1) year after the date of delivery of this product by QBIT.

The warranty does not apply to parts the instruction manual designates as having a limited shelf-life or as being expended in normal use (e.g. filters).

Excepting those parts subject to maintenance, disassembly, change or modification to the instrument will void the warranty. Any control, adjustment or procedure different from those reported in the present manual will also void the warranty.

# CHAPTER I

## SAFETY

Safety is essential in the use and maintenance of the equipment. Therefore the present chapter provides important safety information concerning the operation and maintenance of the LCT-14 system.

### **I.1. GENERAL SAFETY**

The system LCT-14 is consistent with the following directives:

- **CE Council Directive 2014/35/EU** (Electrical safety of low voltage equipment);
- **CE Council Directive 2014/35/EU** (Electromagnetic Compatibility).

### **I.2. SAFETY PRECAUTIONS**

Even if the system has been produced in agreement with safety directives, a proper and careful use is very important for safe operation.

**IN ORDER TO CORRECTLY OPERATE THE SYSTEM, IT IS STRICTLY REQUESTED TO FOLLOW THE SPECIFICATIONS REPORTED IN THE NEXT PARAGRAPHS.**

#### **I.2.1. Instrument safe location:**

Locate the equipment on a flat surface, far from heat sources or strong air flows. For the best operation in outdoor applications, the instrument should be placed in protected areas, in order to prevent exposure to strong rainfall, snow or hail. During summer at noontide, it is suggested to avoid exposure to direct sun light.

#### **I.2.2. AC power and grounding:**

The instrument is equipped with an internal 5Ah/24V battery. It may also work connected to the external power supply/battery charger (220 VAC, 50/60 Hz standard line input). Connection with the external 220 VAC line occurs through the power supply plug.

**UNDER NO CIRCUMSTANCES SHOULD THIS INSTRUMENT BE OPERATED WITHOUT CONNECTION TO A PROTECTIVE GROUND. DOING SO CREATES A POTENTIAL SHOCK HAZARD AND IS ALSO A VIOLATION OF ELECTRICAL SAFETY STANDARDS APPLICABLE TO THIS TYPE OF EQUIPMENT.**

#### **I.2.3. Proper use:**

Do not operate this instrument in the presence of flammable liquids, vapors or aerosols.

Both when the equipment is working and when it is not in use, avoid to lean the instrument on the floor, or anywhere it risks to be hit, crushed and thus damaged.

During system operation avoid to obstruct the cyclone inlet and the sample air exhaust on the rear panel.

**CAREFULLY PREVENT ANY LIQUID TO BE SUCKED UP IN THE CYCLONE FILTER;THE INSTRUMENT MAY BE SERIOUSLY DAMAGED.**

#### **I.2.4. In case of malfunction:**

Do not continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, unplug the AC power cord, refer to Chapter VI of the present manual and contact technical service.

**I.2.5. Cleaning:**

Use a dry cloth to clean the outside of the case. Do not use soap and water. Do not use blast of compressed air.

When the system is not in use, it is suggested to set the equipment in a dry, dust free place.



# CHAPTER II

## SPECIFICATIONS

### II.1. OPERATING PRINCIPLE

The Particulate Matter (PM) monitor system LCT-14 by QBIT is based on “Laser Scattering” principle. A sample of air flows through an optical cell, and the laser light scattered by micron-sized particles is measured. This system allows to reconstruct a real-time estimation of the PM present in the sampled air. Anyway, this quantity is not a direct measurement of the PM weight. The amount of scattered light is proportional to PM density, given certain physical, chemical and granular properties of the PM itself. The obtained optical signal is then to be calibrated with reference to a primary system which correctly measures the PM mass. Consequently, in order to guarantee the best accuracy, air sampled during calibration should be as similar as possible to that surrounding the measuring station.

### II.2. ACCURACY AND RESOLUTION – Table II.1

Quantity	Value	Units	Notes
PM signal resolution	1/4096	full scale	(1)
PM signal accuracy	<1%	full scale	full range of measurement times (2)
Maximum PM range	10000	µg/m <sup>3</sup>	factory adjustable (3)
Temperature resolution	0.01	°C	
Temperature accuracy	0.3	°C	(4)
Pressure resolution	0.01	kPa	
Pressure accuracy	0.5	kPa	
Relative humidity resolution	0.04	%	
Relative humidity accuracy	+/- 2	%	20% < R. H. < 80%

(1) As previously specified, PM resolution and accuracy refer to the optical signal produced by the scattered light. The corresponding specs in terms of PM mass are derived from a calibration process affected by the properties of PM itself (carbon based dust produced by heating - typical of winter season – gives a conversion coefficient larger than that of silicon based dust – summer season). Thus it is important to compare the measurements in a given place and time interval with a gravimetric instrument (primary system).

(2) The longer the measurement time, the higher the accuracy will be. With measurement interval larger than 10 seconds, the accuracy may be better than 10<sup>-3</sup>.

(3) The factory selected standard range corresponds to 1500 µg/m<sup>3</sup> full scale. Following (2), this implies a sensitivity better than 2 µg/m<sup>3</sup> with measurement interval lasting 10 seconds or more.

(4) The temperature is measured close to the fan. Due to instrument internal dissipation, it may be different from “environmental external temperature” of few degrees.

### II.3. GENERAL SPECIFICATIONS – Table II.2

Quantity	Value	Units	Notes
Supply voltage	24	V <sub>dc</sub>	From 220 V <sub>ac</sub> power supply or battery
Average power absorption	<5	W	2.2 l/min flow rate
Peak power absorption	15	W	During calibration, with 3 l/min flow rate
Flow rate range	0 - 3	l/min	Software adjustable
PM2.5 cyclone flow rate	2.2	l/min	Factory adjusted
Measurement interval	1-120	sec	SW adjustable
Calibration interval	1-600	min	SW adjustable
Single measure dimension	64	Byte	
Control unit			External tablet
Free memory on disk	~2	GByte	Allows recording more than 1 million measures
Life time	∞		With 220 V <sub>ac</sub> power supply (a)
	>15	hours	With 24V/5Ah battery (a)
	>24	hours	With 24V/8Ah battery (a)

(a) The Tablet (control unit) battery is powered and maintained in charge by the instrument. In case of black-out, the Tablet remains on for about 4 hours; it lets the measurements restart as soon as external power is restored.

#### II.4. CURRENT MODELS (dimension and weight) – Table II.3

Model	Functionality	Internal battery	Dimensions (cm)	Weight (kg)
PC-R	External PC	NO	318x257x152	3.4
T-R	Tablet on board	NO	318x257x152	3.4
PC-B	External PC	24V- 5Ah	318x257x152	5.8
T-B	Tablet on board	24V-5Ah	318x257x152	5.8

#### II.5. EXTERNAL BATTERIES (dimension and weight) – Table II.4

Battery	Voltage	Capacity	Duration / recharge time	Enclosure	Dimensions (cm)	Weight (kg)
UPS	220 Vac	12V -7Ah (84 Wh)	4-5 h / 3h	UPS (plastic)	90x160x285	5.5
Lead 10 Ah	24 V	24V/10Ah	24h / 24h	Metal	100x150x200	8-9
LiFePO 5Ah	24 V	24V- 5Ah (120 Wh)	>15 h / 2.5h	Aluminium	55x146x222	1.5
LiFePO 8 Ah	24 V	24V-8Ah (192 Wh)	~24 h / 4h	Aluminium	105x121x171	2.0

Durations are estimated with tablet powered by the instrument.

#### II.6. TECHNICAL TERMS AND CONFIGURATIONS

**MAIN UNIT:** main case equipped with 24V DC input connector, main switch, cyclone filter, adjustable handle bar.

**POWER SUPPLY/BATTERY CHARGER:** external 220 Vac power supply, with two color led and connection for main unit and battery.

**BATTERY:** external box including connections for battery charger and main unit.

**TABLET:** external control unit connected to the main unit by USB cable.

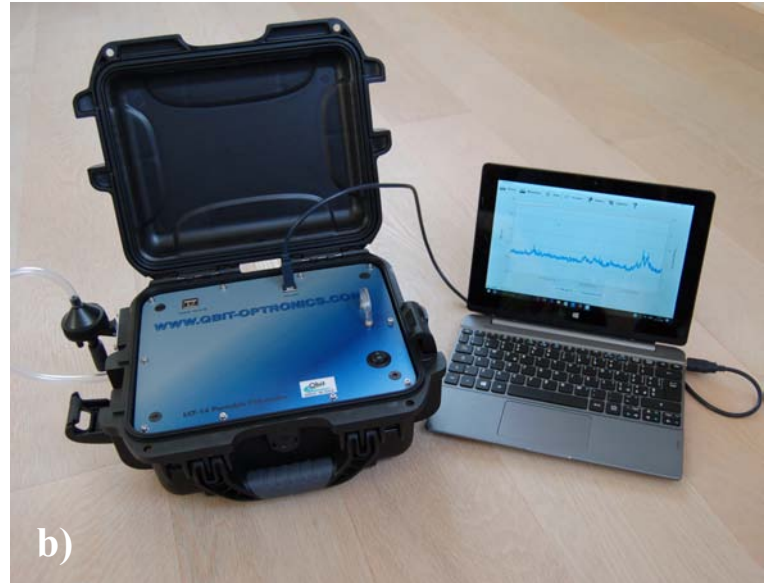


Figure II.1. Configurations.

Figure shows two different set-up of the instrument: a) Blue-tooth connection with tablet (outdoor applications) and b) USB connection with lap-top (indoor applications).

## II.7. DISPOSAL

At the end of lifetime, the system is to be disposed as electronic material, following European Directives 2002/95/EC e 2003/108/EC. The Buyer will contact QBIT s.r.l. to get any instruction about disposal or return of the equipment.

## CHAPTER III

### FUNCTIONAL OVERVIEW

The system LCT-14 is a portable device for real-time detection of Particulate Matter (PM- also called micro-dust) which allows air quality control. The instrument is based on an optical measurement. A sample of air flows through an optical cell, and the laser light scattered by micron-sized particles is measured. Without input pneumatic filter, the LCT-14 is sensitive to any kind of fine dust (with dimensions ranging from fraction of micron to some tens of microns). The class of detected PM (typically PM2.5 or PM10) then depends on the selecting input filter placed at the sample air inlet. The LCT-14 adopts cyclone filters (inertial selection principle). The state-of-the-art detection method, based on laser light scattering, leads to high sensitivity, short response time, reduced ownership costs and long lifetime.

The system consists of an easily portable suit-case (main unit) and a group of accessories, depending on the chosen configuration. The case may be powered from different sources (AC line, batteries and also photovoltaic units). Through USB and Blue-tooth interfaces, it may be connected to several control devices: computer, tablet or smartphone.

The present manual refers to the standard configuration, including a mini-Tablet (powered by the main unit); it specially suits measurements where portability and full autonomy are requested.

The LCT-14 is excellent for any application in air quality control, and for installation and maintenance of large industrial plants. In these fields, the LCT-14 allows monitoring of dust emissions, thus contributing to the control of environmental pollution.

#### III.1. MAIN PANEL

By releasing the lateral blocking locks of the case it is possible to lift the cover and access the main panel (Figure III.1).



Figure III.1. Main panel.

1) Main switch. 2) USB plugs: right USB-B [data] and left USB-A [Power 5V-2A]. 3) Pneumatic circuit jumper. The cyclone filter (PM2.5) is fixed on the left side of the case.

#### III.1.1. Main switch

The electric power can be switched ON and OFF by means of the black switch located on the main panel.

#### III.1.2. Identification plate

Below the main switch, the instrument identification plate reports the model and the serial number.

#### III.1.3. USB-B plug (data)

The USB-B plug is used for connecting the main unit with a control unit like a tablet (standard version), a PC or a smartphone. The control unit is interfaced by means of a proprietary software described in the appendix of this manual. All measurement files (ASCII-standard) are saved in the memory of the control unit, and later are uploaded to the server, where they remain stored and can be shared with other users.

#### III.1.4. USB-A plug (power)

Over the main panel, an USB-A plug is available only for powering the external control unit (5V-2A, no data transfer). If the tablet or smartphone is equipped with only one USB connection, control and data transfer shall occur via the Blue-tooth interface. This plug may also be used for powering an external wireless router.



Figure III.2 Main panel USB plugs:  
1) USB-A [Power 5V-2A] and 2) USB-B [data]



Figure III.3 USB-A connection. The external control unit, connected and powered via USB-A, remains working with the instrument. In this way, working time is not limited by the internal battery if the main unit is connected to 220VAC line.

### III.1.5. Pneumatic circuit jumper

Above the main switch, a pneumatic circuit jumper is placed. By removing the short plastic tube it is possible to insert an external filter which remains in series between the pump and the optical cell. By this accessory, the PM accumulated on the filter may be weighed (calibration with reference to a primary system which measures the PM mass) or chemically analyzed after the measurement session.

## III.2. REAR PANEL

In Figure III.4 the rear panel is shown.

### III.2.1. Sample air exhaust

The large grey plate (Gore-vent) in the center allows air exchange with the environment. This exhaust is protected by gore-tec tissue to avoid water or mist inlet.

### III.2.2. Environmental sensors

On the left side is placed a cylindrical enclosure containing the environmental sensors (temperature, pressure, relative humidity). These devices are located outside the main unit in order to obtain a reliable monitor of the external parameters. The top of the enclosure is open, to allow air exchange. Take care to avoid water immersion or jets.



Figure III.4. Rear panel.

## III.3. PM FILTERS AND ACCESSORIES

### III.3.1. PM filters

The class of detected PM (typically PM<sub>2.5</sub> or PM<sub>10</sub>) depends on the selecting input filter placed at the sample air inlet. The LCT-14 may adopt both cyclone filters or porous filters. Figure III.5 shows two different devices. The first is of the cyclone type (inertial selection) for PM<sub>2.5</sub>, the second is of the porous type (mechanical selection) for PM<sub>10</sub>. The procedures for filter mounting and all the electronic settings to match the instrument configuration with the chosen selector are reported in chapter V.





Figure III.5. PM selectors. a) PM2.5 cyclone filter. b) PM10 porous filter.

### III.3.2. Power supply / battery charger

Figure III.6 shows the power supply / battery charger for the LCT-14 (29V -  $I_{max}=2.5A$  ). This unit may be used as power supply for those instruments without internal battery. When the battery is enclosed, it works both as power supply and battery charger (even with instrument turned off). It is equipped with a led indicator: red during charging cycle, green when the battery is charged completely.



Figure III.6 Power supply / battery charger.

### III.3.3. Optional accessories

The optional accessories available are the external battery (to increase the working time in outdoor applications) and a wireless router which allows data transfer through mobile telephone network (whenever this option is not present on the control unit).

Figure III.7 reports the LiFePO<sub>4</sub> battery rated 24 V – 8Ah . This battery allows 24 hours of working life-time to the system [main unit + tablet] in standard operating conditions (flow rate 2.2 l/min for PM2.5 selector). It may be employed also in presence of the internal battery.

The battery box presents two connectors. The first to be connected to the main unit, the second to be connected to the battery charger. The instrument may be powered using the battery and the battery charger at the same time. Such configuration allows continuous operation even in occurrence of a black-out, thanks to the battery. Anyway, it is always suggested to start measurement sessions with completely charged batteries.



Figure III.7 External battery. 1) LCT-14 plug. 2) Battery-to-charger connector.

Figure III.8 shows the wireless router supplied by the USB-A plug on the main panel. This accessory allows internet connection through mobile network.





Figure III.8. External wireless router.

#### III.4. MANUAL

The present operating manual is an accessory of LCT-14. Retain these instructions for future reference. Electronic version of any technical document is also available at the URL [www.qbit-optronics.com/](http://www.qbit-optronics.com/) .

## CHAPTER IV

### PREPARING FOR OPERATION

#### **NOTICE:**

**ANY CONTROL, ADJUSTMENT OR PROCEDURE DIFFERENT FROM THOSE REPORTED IN THE PRESENT MANUAL MAY CAUSE ERRORS AND/OR INSTRUMENT IMPAIRMENT.**

#### **IV.1. LOCATION**

Locate the equipment on a flat surface, far from heat sources or strong air flows. For the best operation in outdoor applications, the instrument should be placed in protected areas, in order to prevent exposure to strong rainfall, snow or hail. During summer at noontide, it is suggested to avoid exposure to direct sun light.

#### **IV.2. INITIAL OPERATION**

Unpack the instrument and accessories. Connect the AC power cord to the instrument and then plug the power cord into a nearby AC line connector. Let the system supplied until the battery is fully charged (the led light on the battery charger switches from red to green).

**UNDER NO CIRCUMSTANCES CAN THIS INSTRUMENT BE OPERATED WITHOUT CONNECTION TO A PROTECTIVE GROUND.**

#### **NOTICE**

**Do not operate this instrument in the presence of flammable liquids, vapors or aerosols.**

**Both when the equipment is working and when it is not in use, avoid to lean the instrument on the floor, or anywhere it risks to be hit, crushed and thus damaged.**

**During system operation avoid to obstruct the cyclone inlet and the sample air exhaust on the rear panel.**

**CAREFULLY PREVENT ANY LIQUID TO BE SUCKED UP IN THE CYCLONE FILTER;THE INSTRUMENT MAY BE SERIOUSLY DAMAGED.**

## CHAPTER V

### SYSTEM FUNCTIONALITY

#### V.1. CYCLONE FILTER MOUNTING

The class of detected PM (PM<sub>2.5</sub>, PM<sub>10</sub>) depends on the selecting input filter placed at the sample air inlet. The LCT-14 adopts cyclone filters (inertial selection principle) that are calibrated for a given air flow rate, so that heavier particles are not allowed to enter the measuring chamber. Although the correct flow rate is factory adjusted, the user is committed to change this setting (both in case of any flow derating and if a different input filter is adopted) by digitally tuning the pump speed through the software. After this operation, it is always suggested to verify the revised flow rate with an external flow meter placed at the instrument air inlet.

For the correct cyclone mounting, use the two M3 screws indicated by the red arrows in Figure V.1. The soft end of the plastic tube and the blue terminal should be connected to the filter cap and to the main case, respectively (white arrows). The blue terminal should be pressed into the fast connector. In order to unplug the tube from the case, press the connector external ring and pull the tube out (take care not to separate the plastic tube and the blue terminal).

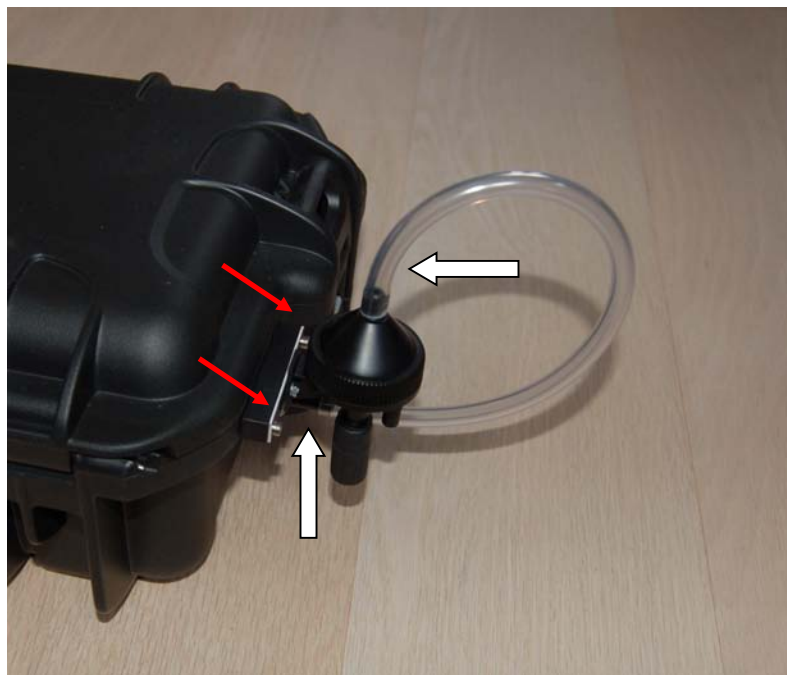


Figure V.1. Cyclone filter connections.

In order to obtain the correct PM reading for a given cyclone filter, the proportionality factor among optical signal and PM density ( $\mu\text{g}/\text{m}^3$ ) is to be set in the instrument software. Figure V.2 shows the corresponding panel in the “Options” menu.

According to factory calibration, **g1=1.0** for **PM2.5** cyclone filter and **g1=1.6** for **PM10** cyclone filter. The adoption of different filters and the in-situ calibration with reference to a primary system (gravimetric measurement) may lead to a different value for **g1**. Similarly, the other proportionality factors (**g2** - temperature, **g3** – pressure, **g4** – humidity) can be rescaled.

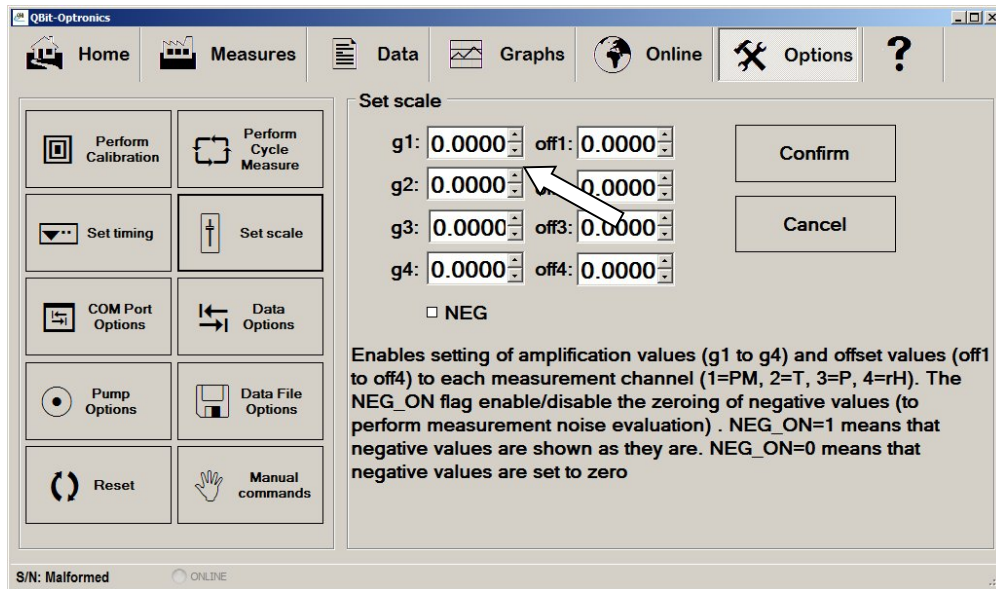


Figure V.2. Parameters setting (Windows version).

## V.2. POWER SUPPLY CONNECTIONS

### V.2.1. Connection to external AC line

The link to an external AC line is obtained through the 29 V power supply/battery charger (Figure V.3 white arrow). Connect the male and female black/blue connectors and tighten the safety nut.



Figure V.3. Connection to AC line.

### **V.2.2. External battery connection**

When an external battery is present, connect it to the case through the black/blue connector (Figure V.4). This configuration allows outdoor operation even when the main case is not equipped with internal battery. If internal battery is present, the working life-time is increased. The external battery may also be powered by means of the battery charger.



Figure V.4. Connection to external battery.

### V.3. TABLET AND INSTRUMENT

The standard configuration of the instrument adopts a tablet as control unit, powered by the main case via the USB-A plug (Figure V.5). Data connection occurs by wireless Blue-tooth interface. The tablet is delivered with its original package. It is suggested to retain the package where serial and product numbers are reported. Warranty does not apply if these identification numbers are lost.

This configuration allows the use of most tablets or smartphones, which are usually equipped with only one USB (or micro-USB) connector. If more than one USB connector is present, data may be exchanged by USB-B port on the main panel.

In order to drive the instrument and continuously save recorded data in long-term operation saving battery lifetime, the control unit display is set with reduced brightness. It is also suggested: 1) to start measuring sessions having any batteries 100% charged, 2) to set the tablet without suspension procedures (e.g. energy saving). Moreover maintaining the tablet in charge is important since the QBIT software in measurement operation re-starts data recording whenever any interruption is occurred. This may happen for example in presence of a black-out when the main unit is supplied by external AC line.

The tablet is supplied with 4 velcro-straps, which allow to fix it on the main unit, preferably over the main panel (Figure V.5) or in the suit-case cover. In this case and whenever the suit-case is closed, attention should be paid to avoid any mechanical interference with the pneumatic circuit jumper over the main panel (III.1.5).





Figure V.5. Tablet location.

Placing the tablet over the main panel optimizes the path of the 90°-connectors USB cable and the case can be easily closed also during measurements. When the tablet is factory supplied, all these settings (drivers upload, Blue-tooth pairing, etc.) are prepared, but they may be changed through standard utilities. The tablet is turned on and off by a prolonged pressing on the main switch. The tablet stand-by condition (short pressing of the switch) is not suggested, since it may cause an unwanted battery run-down. A fast battery recharge can be obtained connecting the tablet (preferably switched off) to the external line by means of its battery charger (see Figure V.6).

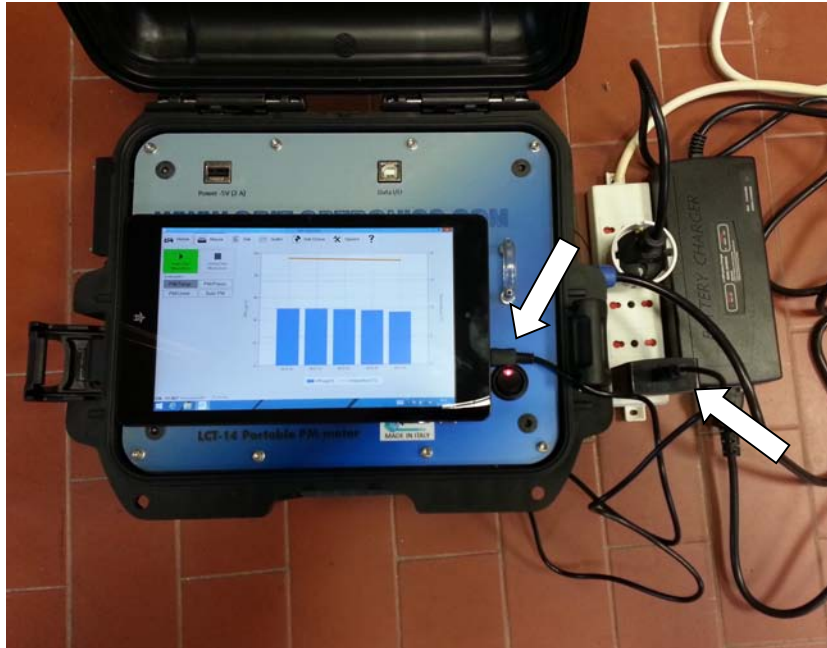


Figure V.6. Tablet AC line connection.

After tablet turn-on and splash-screen (username=qbit, password=qbit), the user can access the QBIT control software through the icon on the desktop.

#### V.4. MAIN UNIT TURN-ON

The main unit is turned on with the black switch (O/I) placed over the main panel, just above the identification plate. The tablet is charged by the main unit only if the main unit is on.

When the main unit is switched on the internal fan is also activated. The internal pump starts working only when a measurement cycle is initiated by the QBIT dedicated software. This software is pre-installed on the tablet and it is available as a Windows application or in the desktop bar of Windows start menu.

#### V.5. INSTALLATION AND SW START-UP

The QBIT application (Figure V.7) is factory pre-installed in the tablet, and the start icon is in the application bar of Windows desktop. It is possible to down-load the software from QBIT web-site ([www.qbit-optronics.com/software\\_qbit/](http://www.qbit-optronics.com/software_qbit/)) if software recover is necessary or any new revisions are available. The down-load procedure is password protected. The user password can be obtained sending an e-mail to: [tech@qbit-optronics.com](mailto:tech@qbit-optronics.com). The software is also available as an auto-installing executable file.

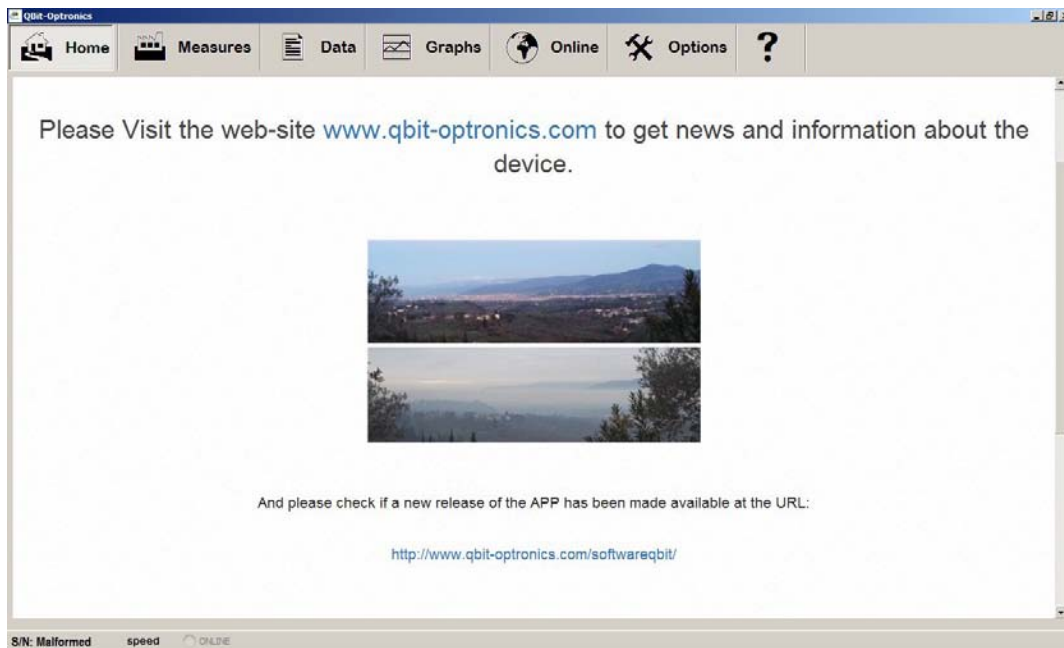


Figure V.7. SW start panel.

## V.6. QBIT APPLICATION FOR LCT-14

The QBIT application is available among the other applications of the operative system, or in the desktop start-menu bar. In order to enter the instrument control window it is sufficient to launch the application.

The complete software description is reported in the appendix. The first operation to do is to enter the “Options” menu and set the correct serial port (typically COM3, sometimes a successive number if the tablet has been already interfaced with other virtual-com devices). With the rotating-arrows key it is possible to see the complete list of available ports. Select the correct one from the “Ports (COM & LPT)” window and confirm by pressing OK. If the procedure has succeeded, the instrument serial number is displayed in the lower application bar. If the COM to be selected is unknown, unplug the USB cable from the tablet and verify again the list of available COMs. The one disappeared from the list is that automatically assigned by the tablet to the main unit. Connect again the USB and repeat the COM selection procedure.

The Qbit software presents a simple and friendly graphic interface. The full SW description is also available at the following URL

[www.qbit-optronics.com/it/wp-content/uploads/2015/07/Guida\\_Software\\_Qbit-Optronics\\_ver11.pdf](http://www.qbit-optronics.com/it/wp-content/uploads/2015/07/Guida_Software_Qbit-Optronics_ver11.pdf)

The Qbit application is optimized for the full screen resolution of the tablet (that is screen zoom set to 100%). Anyway, it may be not practical to use the touch screen with such resolution in Windows desktop mode. Of course, it is convenient to change this setting, especially if managing files. Reset the zoom to 100% when the Qbit application is restarted.

# CHAPTER VI

## TROUBLESHOOTING

### VI.1. TROUBLESHOOTING

In Table VI.1, the most frequently occurring errors and malfunctions are reported, together with any user countermeasure. If malfunction persists, please contact technical assistance.

**Table VI.1**

Malfunction	What to do
Main unit turn-on failure	Verify that the power cord is connected and AC required specifications are met. Check the warning light on the power supply. If light is off the power supply is damaged.
Tablet turn-on failure	Verify the charge level of the battery. Disconnect the tablet from the main unit and charge it with the external charger. Then try again.
Software commands are ignored	Verify the correct selection of the COM port (paragraph V.6). If the problem persists turn off the instrument and restart it.
Temperature too high	Turn off the system and wait at least 30 minutes to allow cooling. Reduce the working place temperature or move the instrument to a cooler location. Verify that the Gore-vent is not obstructed.
Temperature, pressure and humidity measures do not match other external instruments	Verify that the environmental sensors enclosure is not obstructed. Calibrate the sensors with the SW application.
The internal pump is too noisy	Verify that the cyclone is correctly connected. Calibrate and verify the flow rate. Inspect the pneumatic circuit jumper on the main panel.
Flow rate can not be changed	Verify that the flow meter is correctly connected to the air inlet. Inspect the pneumatic circuit jumper on the main panel.
PM measures are irregular	Verify the flow rate and that cyclone filter is correctly connected. Inspect the pneumatic circuit jumper on the main panel.
Internet connection is not working	Verify the charge level of the external router. Verify the available credit of SIM.

## CHAPTER VII

### MAINTENANCE

For a long and reliable operation of the LCT-14 system, a few maintenance operations are suggested to be performed by the user and by qualified personnel.

#### VII.1. USER MAINTENANCE

##### VII.1.1. Cleaning suggestions

Daily cleaning

- remove dust and solid particles from the instrument;
- do not use abrasive products;
- wipe with soft and clean cloths.

Precautions

- avoid dust or grease get into the cyclone filter;
- avoid moisture or liquids get into the cyclone filter;
- avoid dust get into the main case apertures;
- do not use chemical solvents and/or abrasive detergents;
- do not use alcohol to clean the tablet and the main panel.

**ALWAYS DISCONNECT THE AC POWER BEFORE ANY MAINTENANCE OPERATION.**

**When the system is not in use, it is suggested to set the equipment in a dry, dust free place.**

##### VII.1.2. Cyclone filter cleaning

This maintenance operation can be performed by the user, at time intervals which depend on working conditions and external environment.

Disconnect the cyclone filter from main unit. Open the conical filter cap unscrewing the circular nut. Clean out the dust from the internal chamber and verify that the air inlet is not obstructed. Remount the cap. Remove and clean the rubber cap placed below the filter.

##### VII.1.3. Flow rate setting

The user is committed to change the flow rate setting (see also III.1.4), both in case of any flow derating and if a different input filter is adopted.

Disconnect the cyclone filter from the main unit and connect the flow meter to the fast connector using an 8 mm external diameter tube.

Access the pump setting menu in the QBIT software and select the "Pump options" sub-menu (Figure VII.1). Turn on the pump with the "start pump" button. Tune the pump speed value [0-100%] to obtain the desired flow rate. Of course, this value may depend not only on the cyclone type but also on the pneumatic circuit (if a long tube is used to connect outdoor cyclone with indoor main unit, higher values of pump speed are necessary). Typically, in standard configuration, a 2.2 l/min flow rate (PM2.5 cyclone) is obtained with 40% pump speed. Finally, disconnect the flow meter and reconnect the cyclone filter.

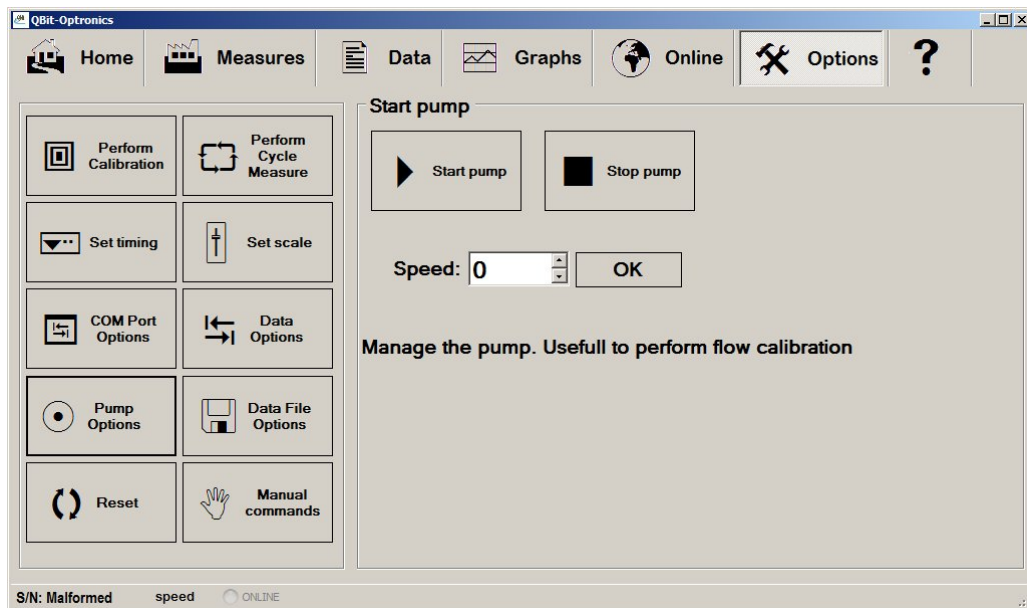


Figure VII.1. Pump setting panel.

## VII.2. QUALIFIED PERSONNEL MAINTENANCE

**IN ORDER TO ENSURE SYSTEM ACCURACY AND RELIABILITY, THE FOLLOWING MAINTENANCE OPERATIONS ARE TO BE PERFORMED BY QUALIFIED PERSONNEL AT REGULAR INTERVALS (PREFERABLY ONCE A YEAR):**

- internal zero-pass filter replacement;
- laser scattering sensor calibration;
- flow rate calibration;
- electric insulation check.